

WHAT IS CLAIMED IS:

1. A device for detecting a selected analyte, comprising:

a stably transformed bacterium containing a promoterless *lux* gene cassette having a regulatory element for a selected analyte inserted in front of the *lux* gene cassette;

a support matrix onto which the bacterium is attached; and

an encapsulating material to contain said bacterium attached to the support matrix

wherein the encapsulated bacterium emits visibly detectable light in the presence of the selected analyte.

2. The device of claim 1 wherein the *lux* gene cassette comprises *merRo/p-lux*.

3. The device of claim 2 further comprising a *merRo/pA-lux* gene cassette incorporated into the transformed bacterium.

4. The device of claim 1 wherein the analyte is naphthalene, toluene, ethylbenzene, 2,4-dichlorophenoxyacetic acid, β -phenyl ethylamine, phenol or biphenyl.

5. The device of claim 1 wherein the analyte is mercury.

6. The device of claim 1 wherein the regulatory element comprises a *mer* regulatory element.

7. The device of claim 4 wherein the regulatory element further comprises a *mer* operator.

8. The device of claim 1 wherein the bacterium is *P. fluorescens*.

9. The device of claim 6 wherein the *P. fluorescens* is *P. fluorescens* 5R.

10. An apparatus comprising the device of claim 1.
- 5 11. The apparatus of claim 10 comprising a holder for the support matrix onto which the bacterium is immobilized.
12. The apparatus of claim 11 adapted to hand-carrying.
- 10 13. A genetically modified bacterium responsive to divalent mercury, said bacterium containing a *merRo/p-lux* gene stably integrated into the bacterial chromosome wherein said bacterium produces a bioluminescent protein in the presence of divalent mercury.
14. The genetically modified bacterium of claim 13 that is encapsulated.
- 15 15. The genetically modified bacterium of claim 14 that is encapsulated in a matrix selected from the group consisting of alginate, carrageenan, acrylic vinyl acetate copolymer, latex, polyvinyl chloride polymer, sol-gels, agar, agarose, micromachined nanoporous membranes, polydimethylsiloxane (PDMS), polyacrylamide, polyurethane/polycarbamyl sulfonate and polyvinyl alcohol.
- 20 16. The encapsulated genetically modified bacterium of claim 14 that is attached to a support matrix.
- 25 17. The encapsulated genetically modified bacterium of claim 16 wherein the support matrix is cellulose, glass, colloidal noble metal, plastic, laminin or resin.
18. A cellulose support comprising the genetically modified bacterium of claim 13.
- 30 19. A kit for detecting mercury II ion comprising the genetically modified bacterium of claim 13 adhered to an immobilization support and instructions for use in detecting mercury ion.
20. The kit of claim 19 further comprising a second genetically modified bacterium harboring a stably integrated *merRo/pA-lux* gene.
- 35 21. The kit of claim 19 or claim 20 further comprising a direct visual assistance device.

22. The kit of claim 21 wherein the direct visual assistance device is a light-tight box or night vision goggles.
- 5 23. The kit of claim 19 or 20 wherein the genetically modified bacterium is *P. putida* 2440, *P. fluorescens* 5R, *P. putida* F1, *Escherichia coli*, *Vibrio fischerii*, *Vibrio harveyi*, or *Bacillus subtilis*.
24. The kit of claim 23 wherein the bacterium is *P. fluorescens* 5R.
- 10 25. A method for detecting mercury comprising
- contacting a sample suspected of containing mercury II ion with a bioreporter bacterium genetically modified to contain a *merRo/pA-lux* gene; and
- detecting the presence of the mercury ion when a visibly detectable luminescence is produced.
26. The method of claim 25 wherein the bioreporter bacterium is *E. coli* ARL1, ARL2 or ARL3.
27. The method of claim 25 wherein the bioreporter is encapsulated or immobilized.